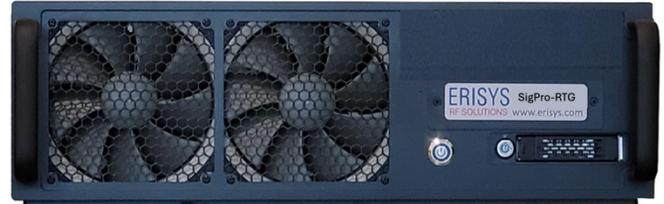


Data Sheet

SigPro® RTG

1 GHz IBW Real-Time Hardware-in-the-Loop Radar Target Generator**Overview**

The ERISYS SigPro® Radar Target Generator (RTG) delivers high performance, precise, and flexible RF radar scenario simulations. The SigPro® RTG provides realistic 3D real-time radar target generation with a powerful yet easy-to-use graphical user interface.



The system accepts direct radar signals and places them into a user-created 3D scenario. Multiple RF configurations can be selected to meet specific individual requirements. The RTG provides real-world signal characteristics for each radar selected.

SigPro® RTG capabilities include:

- **Wide Frequency Range**- 100 kHz to 67 GHz frequency coverage. The frequency range easily expands by simply swapping out standard off-the-shelf components.
- **Expansive RF Bandwidth**- Up to 1 GHz IBW (Instantaneous Bandwidth) to emulate or replicate current sophisticated radar systems.
- **10-Nanosecond to CW Pulse Widths**- Precisely replicate radar pulses of any duration, including the most complex Modulation on Pulse (MOP).
- **Multiple Independent Targets**- Simulate up to six separate targets with distinct 3D paths and aspect-dependent radar returns. Accurately reproduce distance, velocity, and maneuvers to assess radar tracking limits. Combine multiple SigPro® RTG systems together for swarm simulations.
- **Minimal Latency**- Less than 12 microseconds. Minimum simulated target range approximately 1 nmi. Advanced large-scale Field Programmable Gate Array (FPGA) technology enables genuine dynamic real-time performance. FPGAs facilitate real-time target emulations, ensuring simulated echoes accurately preserve the characteristics of the original transmitted radar waveform.
- **Up to 7- Million Target Location Updates per Second**: Ensures smooth target emulation with precise reproduction of real-world target dynamics. User definable.
- **Environmental Effects**- Accurately simulate radar returns with delay, velocity (Doppler), attenuation, fading, noise, interference, and sea clutter.

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SigPro® RTG

- **True 3D Dynamic Test Scenario Simulation-** The test system models platform movement, including position, path (speed, direction, roll, pitch), and system features such as antenna orientation, beamwidth, and scanning patterns.
- **High-Fidelity Radar Cross-Section Modeling -** Simulates complex scattering centers and micro-Doppler signatures from rotating parts, such as jet engine blades or helicopter rotors, essential for non-cooperative target recognition (NCTR). Accurately reproduces RCS signatures using Swerling models.
- **ECM Simulation-** Simulations can include jamming techniques such as Range Gate Pull-Off (RGPO), Velocity Gate Pull-Off (VGPO), and spot/barrage noise to evaluate radar resilience.
- **R&S FSW Spectrum Analyzer Provides RF-to-Digital Conversion and SMW Vector Signal Generators Provides Digital-to RF Conversion-** These devices deliver top-tier conversion between RF signals and IQ digital formats. Customers can maximize the value of their investment in high-quality Rohde & Schwarz (R&S) RF test equipment. The system is also future proof, enabling seamless upgrades as requirements change or new test equipment becomes available.
- **Simple, Intuitive Graphical User Interface (GUI)-** The ERISYS RTG control software features an easy-to-use GUI for setting up scenarios, adjusting parameters, and monitoring simulations, including automatic configuration and control of the R&S FSWs and SMWs.
- **Record Transmitted and Response RF Signals-** An optional ERISYS® SigPro®-4000B recorder and ERISYS® ZoomOut™ analysis software can capture transmitted and returned RF signals with precise time and phase alignment for thorough forensic analysis and validation.

Applications

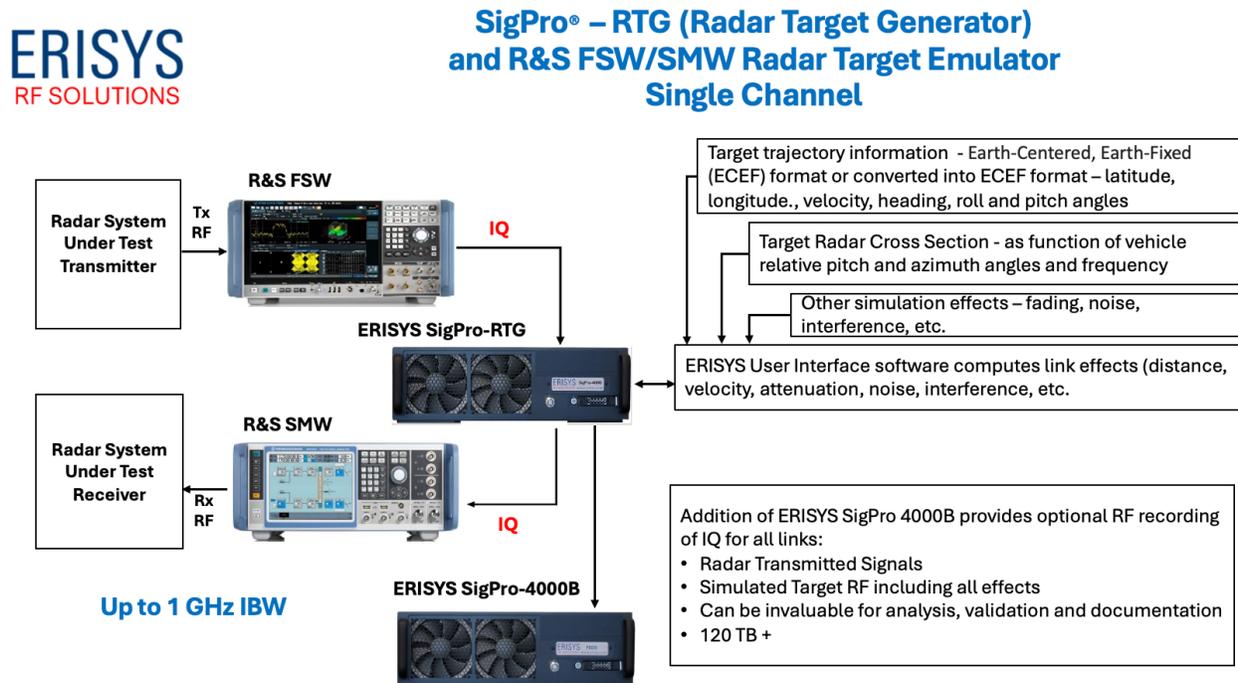
- **Radar System Performance Analysis** – Dynamically simulates the real-world including complex threat at virtually any range, velocity, and maneuver characteristics including fading, clutter, and noise.
- **Radar System Testing and Development** – Validates the performance of all types of ground, ocean and airborne radar and fire control systems. Precisely evaluate new techniques, modulations and methods. A powerful tool to support development of new capabilities and systems.
- **Training** – Provides engineers and users with a precise tool for emulating radar system performance with actual radar waveforms in simulated real-world conditions. Create powerful and flexible testbeds for engineering and technical training under nominal or the most extreme abnormal conditions.

Data Sheet

SigPro® RTG

Typical System Configuration

The diagram below illustrates a standard SigPro® RTG system. A R&S FSW spectrum analyzer tunes to the selected segment of the RF spectrum, up to 1 GHz IBW, containing the test radar signals and converts this to high-quality digital I&Q data. The models of FSW spectrum analyzer and SMW vector signal generator are selected to address the required frequency ranges. Alternative off-the-shelf test equipment may be repurposed for use within the RTG system if desired. Both the FSW and SMW can be upgraded to expand frequency coverage or enhance RF performance. The RTG can accommodate evolving test requirements and newly available model options.



Test scenarios are generated using ERISYS RTG Control Software, which features user-friendly GUI tools for 3D-modeling, in Earth-Centered-Earth-Fixed (ECEF) coordinates, including dynamic platform and target behavior. The software produces detailed simulation parameter tables with up to 1 million updates per second, ensuring smooth simulations without artificial discontinuities.

The SigPro® RTG processes simulated target I&Q data using a large-scale FPGA, then sends it to an R&S SMW, which creates a composite return signal with accurate timing, amplitude, and frequency for all targets. With an optional ERISYS SigPro® 4000B and ZoomOut™ software, users can continuously record both radar transmissions as well as the RTG responses in precise time and phase alignment for detailed engineering analysis.

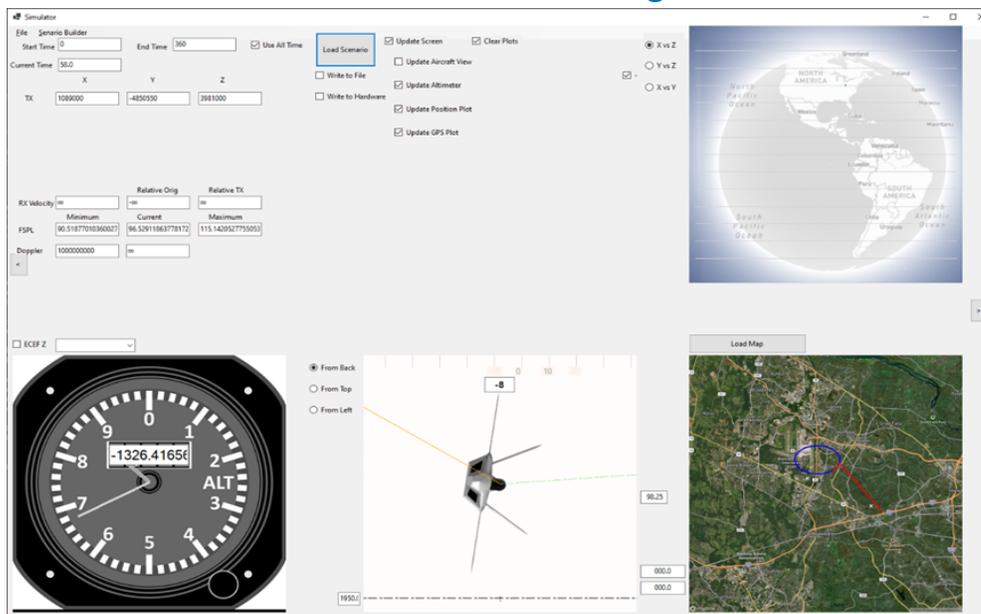
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SigPro® RTG

Graphical User Interface Software

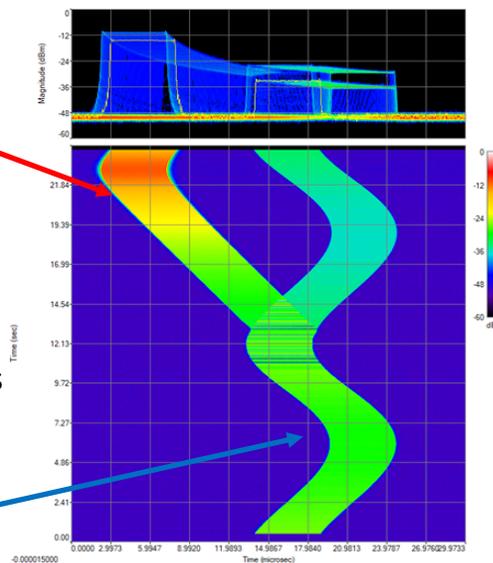
ERISYS SigPro® RTG control software features an intuitive GUI that streamlines the creation and execution of complex 3D multi-threat scenarios. Operators can easily enter scenario data and incorporate visualization tools to verify simulations. Once validated, the software generates detailed simulation parameters, supporting up to 75 million updates per second. This includes all commands and settings for spectrum analyzers and signal generators through a unified control interface.

Missile Launch Simulation Using RTG Control



Circling Aircraft (Doppler and amplitude)

Missile Launch
(Increasing signal strength as approaches radar)



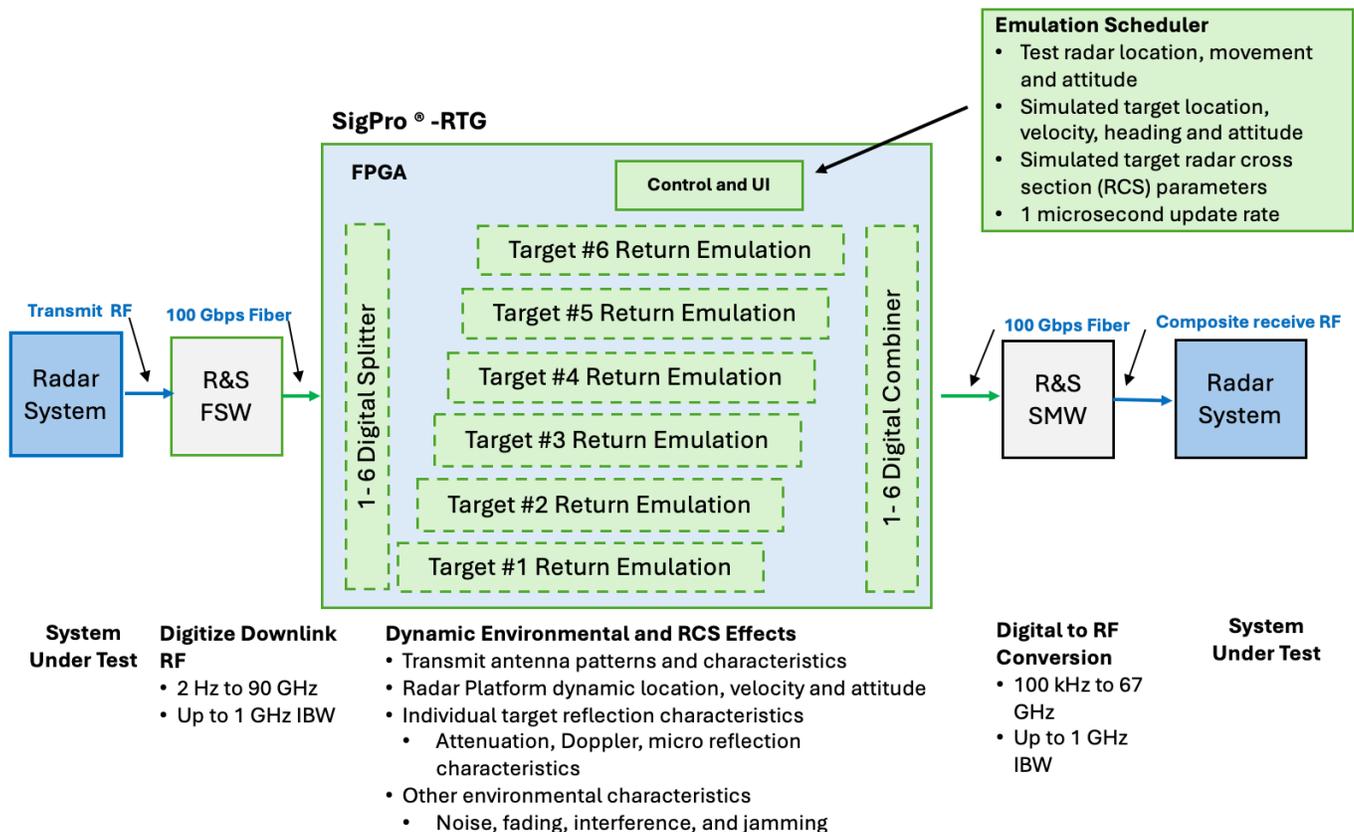
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SigPro® RTG

Signal Processing Flow

All signal processing uses a large FPGA with dedicated parallel processors for each simulated target location and motion relative to the test platform in Earth-Centered-Earth-Fixed (ECEF) format. Analysis covers Radar Cross Section (RCS) versus aspect angle and frequency and can include reflection features like micro-Doppler signatures. The simulation response table is accurately time- and phase-aligned with transmitted RF signals, and includes separation distance, Doppler, attenuation, and antenna gains by aspect angle, noise, sea clutter, and other effects.

SigPro® - RTG Signal Flow



Data Sheet

SigPro® RTG

SigPro® RTG Key Specifications

RF Input Frequency Range	2 Hz up to 90 GHz	Determined by the R&S FSW model used
Instantaneous RF Bandwidth	Up to 1 GHz IBW	Wide bandwidth future-proofs system as radar systems continue to evolve
Phase Noise	-140 dBc (1 Hz) at 10 kHz offset; -143 dBc at 100 kHz (1 GHz carrier)	Ensures high-quality digital signal processing that can accurately reproduce even the most complex modulation techniques
Spurious Free Dynamic Range	60 dBc (for 2 GHz internal analysis bandwidth)	Minimizes introduction of spurs and other undesirable signals
Third Order Intercept (TOI)	+30 dBm (typ.); f < 1 GHz +25 dBm (typ.); f < 3 GHz	Determined by the R&S FSW model used
RF Output Frequency Range	100 kHz up to 67 GHz; Up to 1 GHz IBW	Determined by the R&S SMW model used
Max RF Output Power	+18 dBm	Determined by the R&S SMW model used
Emulation Update Rate	Up to 75 million per second	Smoothly simulates target motion and complex dynamic RCS effects
Delay Range	10 μs to 800ms+	Emulates a wide variety of test scenarios and engagement ranges
Delay Resolution	1 pico-second	Exceptional range modeling
Doppler Shift Range	+/- 500 MHz	Accurately simulates virtually any radar UIT and target relative velocities up to orbital speeds
Doppler Shift Resolution	0.5 Hz	Accurately simulates even the most complex and dynamic target maneuver characteristics
Fading Attenuation Range	70 dB	
IMUX Filter	Up to 1024 complex FIR Coefficients; 1.2 G s/s	
Fading Simulator	Up to 32 taps	
Digital I/O Channels	4 QSFP-DD fiber links	
Size	19" Rack; 3U (5.25") H; 18.5" D	19"- rack transport case or tabletop
Weight	20 lbs.	Easily transportable
Power	120-240 VAC; 250 W	
Display	Up to 2 HDMI external monitors	

We help you solve your previously unsolvable RF spectrum challenges

For more information, please contact ERISYS RF Solutions for consultation and on-site demonstration.

We have decades of experience with EW oriented RF Spectrum Analysis and signal generation.

You can reach us on the web at www.erisys.com or via email at sales@erisys.com.